CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A photoconversion device comprising:

a substrate having a surface;

a first doped region having a first conductivity type and located below the surface of the substrate at an ultrashallow depth, wherein said first doped region is doped with indium; and

a second doped region having a second conductivity type located beneath said first doped region for producing photogenerated charges.

2. The photoconversion device of claim 1 wherein said first conductivity type is p-type.

3. The photoconversion device of claim 1 wherein said first doped region is implanted at a depth of about 800 Å.

4. The photoconversion device of claim 1 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

5. A photoconversion device comprising:

a substrate having a surface;

a first doped region having a first conductivity type and located below the surface of the substrate at an ultrashallow depth;

a second doped region having a second conductivity type located beneath said first doped region for producing photogenerated charges; and

the first and second doped regions both including indium ions, the indium ions in the first region acting as electron acceptors, the indium ions in the second region acting as electron donors.

6. The photoconversion device of claim 5 wherein said first doped region is implanted with indium at a depth of about 800 Å.

7. The photoconversion device of claim 5 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

8. An electronic diode comprising:

a substrate having a surface;

a first doped region having a first conductivity type and located below the surface of the substrate at an ultrashallow depth, wherein said first doped region is doped with indium; and

a second doped region having a second conductivity type located beneath said first doped region.

9. The diode of claim 8 wherein said first conductivity type is p-type.

10. The diode of claim 8 wherein said first doped region is implanted at a depth in the range of about 800 Å.

11. The diode of claim 8 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

12. A processing system comprising:

a processor; and

an imager coupled to said processor, said imager comprising:

a substrate having a surface;

a photosensitive area within said substrate for accumulating photo-generated charge in said area, said photosensitive area having a first doped region having a first conductivity type and located below the surface of the substrate at an ultrashallow depth wherein said first doped region is doped with indium and a second doped region having a second conductivity type located beneath said first doped region; and

a readout circuit comprising at least an output transistor formed on said substrate.

13. The system according to claim 12 wherein said first conductivity type is p-type.

14. The system according to claim 12 wherein said first doped region is implanted at a depth in the range of about 800 Å.

15. The system according to claim 12 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

16. An imager comprising:

a substrate having a surface;

an array of pixel sensor cells formed on said substrate; each pixel sensor cell comprising:

a photosensitive area within said substrate for accumulating photo-generated charge in said area, said photosensitive area having a first doped region having a first conductivity type and located below the surface of the substrate at an ultrashallow depth wherein said first doped region is doped with indium and a second doped region having a second conductivity type located beneath said first doped region; and

signal processing circuitry formed in said substrate and electrically connected to the array for receiving and processing signals representing an image output by pixels of the array and for providing output data representing said image.

17. The imager according to claim 16 wherein said first conductivity type is p-type.

18. The imager according to claim 16 wherein said first doped region is implanted at a depth in the range of about 800 Å.

19. The imager according to claim 16 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

20. A method of forming a photodiode comprising:

forming a substrate having a surface;

forming a first doped region having a first conductivity type at an ultrashallow depth below said surface of said substrate, wherein said first doped region is doped with indium; and

forming a second doped region having a second conductivity type and being located beneath said first doped region.

21. The method according to claim 20 wherein said first conductivity type is p-type.

22. The method according to claim 20 wherein said first doped region is implanted at a depth in the range of about 800 Å.

23. The method according to claim 20 wherein the concentration of said indium dopant is in the range of about $1 \times 10^{18}/cm^3$ to $5 \times 10^{18}/cm^3$.

24. The method according to claim 20 wherein said method further comprises annealing the substrate at an elevated temperature for a limited amount of time.

25. The method according to claim 24 wherein said annealing step further comprises a spike anneal.

26. The method according to claim 25 wherein said spike anneal is performed at about 250° C per second.